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ABSTRACT

This report summarizes the curriculum development and research effort that took place at the Cupertino Apple Classrooms of Tomorrow (ACOT) site from January through June 1987. Based on the premise that computers make revising and editing much easier, the four major objectives emphasized by the computer-intensive writing program are fluency, knowledge of text structures, writing processes, and sharing. Research indicates that the computer helps facilitate each of these objectives. An exploratory study of the ACOT writing program using classroom observations, student work samples, and interviews with teachers indicated that: (1) quality of instruction, not merely access to computers, is the more significant factor in learning to write; (2) students maintained a level of enthusiasm, comfort, and persistence seldom seen when they have to write by hand to plan, draft, and revise their writing; (3) writers were much more willing to share their work when they had legible, computer-produced text on their screens and on the printed page; (4) students wrote more and better when they used computers for their daily writing activities; (5) low-achieving students demonstrated significant improvement in the quantity and elaboration of their writing; and (6) once third-grade students learned to keyboard an average of 26 words per minute, they were able to record thoughts faster than they could by hand. Critical findings emerging from the study are: (1) any sound writing program can be better facilitated when children write with computers regularly; (2) effective instruction is critical for students to become competent writers; and (3) collaboration between teachers and researchers can produce successful research-based instructional programs. (5 references) (GL)

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*Research*

**Writing**

## A Research-Based Writing Program for Students with High Access to Computers

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## Preface

*The Apple Classrooms of Tomorrow research project explores learning when children and teachers have immediate access to interactive technologies.*

Apple Classrooms of Tomorrow℠(ACOT℠) is a research project that explores learning when children and teachers have immediate access to interactive technologies. To pursue this research focus, ACOT establishes technology-rich classroom sites and encourages teachers to develop new curriculums and methods of instruction that take advantage of the technology. Within these environments, university-based researchers examine the long-term effects of the technology on teaching and learning. The project also supports R&D projects that apply current learning theories in the development of curriculums, tools, and environments that can be integrated into ACOT and other classrooms.

This research summary is one of a series of reports that documents the efforts of ACOT, in collaboration with educators and researchers, to determine how technology can be used most effectively to improve teaching and learning.

For further information about the Apple Classrooms of Tomorrow research project, contact Connie Troy–Downing, Apple Computer, Inc., 20525 Mariani Avenue, M/S 76-2A, Cupertino, CA 95014; (408) 974-5219.

## Introduction

*ACOT teachers report that with daily use of computers, student writers do more revising at the structural as well as the mechanical level. Teachers also note that their students are not only better writers, but they are more confident, motivated, and willing to collaborate than ever before.*

In ACOT classrooms, students routinely use computers to draft, revise, proofread, and print their writing assignments. They are able to use the computer as a tool throughout the entire writing process because in ACOT classrooms, students and teachers have immediate access to computer technologies.

Since ACOT students do so much writing with their computers, they receive keyboarding instruction early on (at least by third grade) and their daily writing activities provide on-going practice. Teachers claim that within a few months, their students can keyboard much faster than they can write by hand. The advantage of speed is that it enables writers to record their thoughts faster and more naturally. Young children who struggle to write a sentence by hand are soon keyboarding paragraphs, providing the teacher with material to teach thought development rather than just word mechanics.

ACOT teachers claim their students do more revising at the structural level as well as the mechanical level, now that they have word processing and other writing software. With technology to simplify proofreading and recopying tasks, writers can focus their energy on thinking, organizing, revising, and refining their ideas. After writing with computer tools for a year, ACOT teachers note that their students are not only better writers, but they are more confident and enjoy writing more than ever before.

The teachers also report that with multiple computers in the classroom, writing can become a collaborative effort because students are more willing to share their work. When their paragraphs are visible (and legible) on the computer screen, the students often consult one another for advice, and from there they easily move into activities such as partner writing and group research projects.

Observations such as these by ACOT teachers have also been reported by other teachers who integrate the use of computer technology into the writing curriculum. Given educators' enthusiasm for word processing and the anecdotal evidence that suggests students' writing improves when they use word processing, the project initiated an

R&D effort designed to apply current research in the development of a computer-intensive writing program. To accomplish this, an ACOT teacher and two researchers joined in collaborative inquiry. Dr. Elfrieda Hiebert and ACOT teacher Phyllis Vogel designed objectives and a writing curriculum that implements research findings on how technology can strengthen a writing program. Dr. Edys Quellmalz developed systematic methods for describing and assessing classroom activities and student achievement.

This report summarizes the curriculum development and research effort that took place at the Cupertino ACOT site from January through June 1987. The report provides a glimpse of the ACOT writing program in action and describes the curriculum objectives as well as how they are strengthened by high access to computer technology. The report also describes assessment methods used to examine and evaluate the progress of student writing and presents the overall findings of the R&D project.

## A Computer-Intensive Writing Program

### Curriculum Objectives

*Based on the premise that computers make revising and editing much easier, this computer-intensive writing program focuses on four major objectives: fluency, knowledge of text structures, writing processes, and sharing. The computer helps facilitate each of these objectives.*

Of all the areas of the curriculum, writing is the one in which computers seem to earn most rapid endorsement from teachers. Many claims have been made as to the advantages of writing with a computer, but there seems to be fairly uniform agreement that computers make revising and editing much easier, and that when children are comfortable with keyboarding, they write more. These observations form the basis for designing a computer-intensive writing curriculum that focuses on four major objectives: fluency, knowledge of text structures, writing processes, and sharing. These objectives are essential with or without computers; however, the presence of computers contributes to all of them.

*Once young writers are fluent at writing they can begin to work on improving it. Students who write with computers (and have keyboarding skills) tend to be more motivated and more fluent.*

### *Fluency*

Research has shown that most American schoolchildren are not fluent writers (Applebee, Langer, & Mullis, 1987). "Fluency" refers to students' ability to express themselves fully in writing, whether the task is a letter, story, or report. This lack of proficiency can be attributed to the fact that writing activities in elementary schools consist primarily of copying or transcribing (Bridge & Hiebert, 1985). Because of the ease of writing on the computer (once students can keyboard) and because of their interest, students tend to write more on the computer. This phenomenon should not be trivialized. For some children, especially poor writers, the issue of quantity is basic. A teacher can hardly teach elements such as organization, focus, and elaboration when students' stories are limited to a few lines. Once students are fluent at writing they can begin to work on improving it. Activities that promote fluency are diary and journal writing (including personal feelings or events) and topic writing (when students have general knowledge of the topic).

*The primary goal of writing instruction is to help students learn to communicate thoughts coherently and cogently in both narrative and expository formats. Students need direct instruction in these areas, supported by computer-printed compositions that highlight problems in structure and content.*

### *Knowledge of Text Structures*

While writing more may be a first goal, fluency is not the end goal of a writing program. The quality of students' writing is obviously of central concern. The aim of writing instruction is to develop writers who can communicate their thoughts coherently and cogently. Effective writing has various features, including focus, elaboration, organization, and interest. In addition, identifiable structures of narrative and expository text are a quality of competent writing. Stories, for example, have common elements such as a problem or goal, development of characters in relation to that problem or goal, and resolution of the problem or goal. Essays have a different set of common structures such as comparison of ideas, analysis of a process, and so forth. Research shows that children's composition skills improve when they receive instruction that guides them in the use of these structures. Very often, students receive little guidance in this area.

A writing program should provide direct instruction in the structures of narrative and expository prose. It may be that consistent use of computers makes this process easier

because computer-printed compositions highlight problems in structure and content. The ease of reading student compositions highlights deficiencies in their ability to build an appropriate structure. With handwritten compositions, however, teachers are often distracted by poor handwriting and therefore do not focus as intently on content and structure (Hiebert, Lennart, & Cottingham, 1982).

### *Writing Processes*

***Students develop fluency and knowledge of text structures through writing compositions rather than isolated practice exercises. The computer's facility to support rapid revision and appealing presentation makes it possible to concentrate on all stages of writing—prewriting, drafting, revising, editing, and sharing.***

Writers employ a number of processes. The *prewriting* process occurs when writers establish what they are going to communicate, the voice they will take, and what they know about the topic. In the *drafting* process, writers put their thoughts on paper. *Revising* occurs when writers get others' responses and/or rework their writing themselves. *Editing* involves attention to mechanics such as spelling and sentence structure. Since most writing is done for an audience, another process could be described as *sharing* with others.

While applying these processes to their writing, students are also developing fluency and knowledge of text structures. This curriculum does not include worksheets and other isolated practice exercises because research shows such practice has little effect on improving these skills (Braddock, Lloyd-Jones, & Schoer, 1963). Instead, students work on revising the compositions they are preparing to share.

Although teaching the writing process is part of any effective writing program, high access to computers can help students learn these processes more effectively. The computer's capability to support rapid revision and appealing presentation means that revising, editing, and sharing become easier.

### *Sharing*

***Writing improves considerably when students write for a legitimate reason to a genuine audience. The computer fosters sharing by making text visible and***

Much of the writing that occurs in school consists of rather artificial "practice" writing for a teacher audience. However, research shows that writing improves considerably when students write for a legitimate reason to a genuine audience (Greenlee, Hiebert, Bridge, & Winograd, 1986). A major goal in any writing program should be to

*legible on the screen and by providing desktop publishing capabilities.*

provide students with practical and appealing reasons to write for a real audience, rather than primarily for the teacher as evaluator.

Since the computer tends to encourage sharing among students, this interest could help create audiences for students' writing. The computer's desktop publishing capabilities can also facilitate students' enthusiasm for sharing their work.

## Instructional Approach

*ACOT teachers use a modeling approach in their writing instruction. The teacher introduces a new genre by demonstrating the writing process for that genre and involving students in the experience.*

At the Cupertino site, ACOT teachers provide direct instruction in narrative and expository prose and pay careful attention to teaching writing as a multistage, often collaborative process. ACOT teachers use a modeling approach in the teaching of writing. As a whole-group activity, they introduce a new genre by demonstrating the writing process for that genre and involving students in the experience. For example, a lesson on how to write a persuasive essay might look like this in the third-grade classroom:

> The children sit in a semi-circle on the floor, practically surrounding Mrs. Vogel. Their eyes focus on a large computer screen and then on the teacher. Their arms are poised and ready to grab the next question.
>
> "What's your favorite place to go on a Saturday or Sunday?" she asks.
>
> "The zoo! A baseball game! My friend's house! Skating!" they fling answers in rapid fire, as Mrs. Vogel collects them on her keyboard and displays the list. They select a favorite place by popular vote—the zoo—and the process continues.
>
> "How can we convince readers that visiting the zoo is the best possible thing to do this weekend?" she asks. Once again, students' answers fly up on the screen and soon they're arguing about which arguments are the most persuasive.
>
> "If I tell my parents the zoo is *educational* they'll take me!" claims one eager contributor.
>
> "But that's no reason for a kid to go," another points out.

"How about if we say that both kids and grown ups will like the zoo because they can pretend they're travelling all around the world to see different animals!" adds another.

After the group selects the most persuasive reasons for visiting the zoo, Mrs. Vogel guides them in formulating a topic sentence and opening paragraph that presents the favorite place and why a reader should go there.

By this time, whispering has reached a crescendo as third graders can't resist chatting about their own favorite places.

"Well, what happens after we convince the reader to go to our favorite place?" Mrs. Vogel asks, re-capturing their attention and moving on to the process of gathering information about the chosen place. Using the same instructional approach, she models how to read and take notes from different sources. In this case, she records facts such as admission fee, hours the zoo is open, whether food is available, if there are facilities, public transportation to the zoo, and so forth. Finally, she involves the children in the experience of synthesizing the information and expressing it in their own words.

When the lesson is over, students go away with a model of how to write a persuasive essay and they also have a printed example. They are ready to work independently or in pairs to repeat the writing process modeled by their teacher.

Earlier in the year, Mrs. Vogel used the same modeling approach to teach students the revising and proofreading stages of writing. Already these procedures have become routine—sometimes the students revise and edit independently and sometimes with an adult, but more often they serve as critics and editors for one another.

## Assessment of the Writing Program: An Exploratory Study

### Data Collection

*Data collection included taking field notes and videotapes of classroom observations and gathering work samples. In addition, an assessment session at the end of the year reviewed the reactions of other experienced teachers.*

In order to explore methods for documenting and assessing ACOT's computer-intensive writing program, researchers used both qualitative and quantitative approaches to collecting data. The primary methods included observation in the classroom and collection of work samples. The data included extensive field notes taken during classroom observations and videotapes that documented some of the writing activities.

Although it was this site's first year in the project, and the study did not call for comparative analysis, observation suggested that the writing of ACOT students was noteworthy in many respects. The question arose as to whether the quality of their writing differed from writing produced by students without continuous computer access. Consequently, an assessment session was held at the end of the school year to get the reactions of other experienced third-grade teachers. During the session, teachers evaluated sets of ACOT and non-ACOT compositions by providing both comments and numerical ratings.

### Overall Findings

*The writing assessment session, teacher interviews, classroom observation, and examination of student materials lead to the following conclusions:*

Based on the writing assessment session, teacher interviews, classroom observation, and examination of student materials collected over the school year, the R&D team made the following conclusions about the writing program piloted in this classroom.

#### *Instructional Approach*

*The quality of instruction, not merely access to computers, is the more significant factor in learning to write.*

All of the data documented the highly effective instructional strategies the ACOT teachers used to introduce, model, and guide the development of student writing.

More specifically, the ratings and discussion that took place during the assessment session suggested that the

quality of instruction, not merely access to computers, is the more significant factor in learning to write. Evaluations of written work in both the ACOT and non-ACOT classes indicated that focused instruction and conscientious revision do promote effective writing.[1]

*Students maintained a level of enthusiasm, comfort, and persistence seldom seen when they have to write by hand to plan, draft, and revise their writing.*

### *Motivation*

Children maintained a high level of enthusiasm for writing over the school year. This was evidenced in classroom observations and also in the students' journal entries, which increased in both quantity and quality. During the writing assessment session, teachers noted that access to computers is likely to enhance students' willingness to write more and revise more. Furthermore, observations over the year revealed a level of enthusiasm, comfort, and persistence seldom seen when students have to write by hand as they plan, draft, and revise their writing.

*Writers were much more willing to share their work when they had legible, computer-produced text on their screens and on the printed page.*

### *Sharing*

Computers helped students make their compositions much more presentable, which encouraged sharing. The incentive for sharing increased immeasurably when students had attractive, legible copy immediately after composing on the computer. In fact, considerable sharing occurred among students even before their compositions were printed. Such spontaneous sharing while writing is rarely seen when children write compositions by hand.

*Students wrote more and better when they used computers for their daily writing activities.*

### *Quantity and Quality*

Students wrote more and better when they had high access to computers. ACOT students did almost twice as much writing as students in other classes during the same time period. In the writing assessment session, ACOT students' sample papers were rated slightly higher overall than those written by non-ACOT students. In addition, ACOT stories had more complicated plots and included more dialogue, suggesting that students tended to take

[1] The UCLA Center for Technology Assessment is currently working with ACOT to develop measures that include the writing process as an integral part of evaluating students' writing.

more risks when writing with computers. While their greater elaboration was not paralleled by an increase in focus, it could be that exploration is an important stage in writing—a stage that many elementary students in typical classrooms never reach. Instruction that guides students in focusing their compositions, after they have become fairly fluent at writing, may overcome this difficulty.

### *Low-Achieving Students*

***Low-achieving students demonstrated significant improvement in the quantity and elaboration of their writing.***

The opportunity to write regularly on computers made a substantial difference for low-achieving students. This was evidenced in the assessment session when ACOT and non-ACOT stories were compared. The most striking difference between the compositions of the two groups was in the quantity and elaboration of the low-achieving students' papers. Another indication of improvement for low-achieving students was in the journal writing activities. Over a six-month period, these students wrote more (in some cases twice as much) and their writing was more interesting, elaborated, and focused.

### *Keyboarding and Handwriting Skills*

***Third-grade students learned to keyboard an average of 26 words per minute. This enabled them to record thoughts much faster than they could by hand. Still, their proficiency in handwriting remained comparable to their peers.***

In October, students typed an average of 16 words per minute with 89% accuracy (compared to seven words per minute in cursive and nine words per minute in manuscript). In June, the keyboarding average was 26 words per minute with 92% accuracy. This keyboarding proficiency enabled students to record their thoughts much faster than when they used a pencil.

ACOT students obtained the same proficiency in handwriting as non-ACOT peers. Third grade is an important year in children's handwriting development since this is typically when the transition from manuscript printing to cursive writing is complete. Since ACOT students did most of their writing on the computer, there was concern that they would not acquire handwriting skills comparable to their peers. Consequently, a comparative study was done between the ACOT students and peers without high computer access. Handwriting samples (students copied the same text) were collected in January and again in June. Samples were rated holistically

on a scale of one (low) to six (high). On both occasions, there were no significant differences between the two groups of students, even though ACOT students spent considerable time writing on their keyboards instead of handwriting.

## Conclusion

*Three critical findings emerge from this R&D effort:*
*• Any sound writing program can be better facilitated when children write with computers regularly.*
*• Effective instruction is critical for students to become competent writers.*
*• Collaboration between teachers and researchers can produce successful research-based instructional programs.*

The results of this curriculum development and research project indicate that, while the objectives of the new curriculum are similar to those of any sound writing curriculum, the objectives can be facilitated to a far greater degree when children write with computers than when they use paper and pencil or have limited access to computers.

The results also highlight the importance of effective instruction. When teachers model all stages of the writing process and assist students in completing these stages, students' opportunities for success are greatly enhanced.

In addition, the results of this R&D effort demonstrate that collaboration between teachers and researchers makes it possible to translate valid research findings into a sound instructional program.

## Implications for the Future

*Further study is needed to determine how students' writing strategies change with daily use of computers. Do writers make increasingly more text revisions on the screen compared to when text is printed on paper? Do students revise differently when they work collaboratively compared to when they work alone? Answers to these and other such questions will help educators determine how best to implement technology in the writing curriculum.*

Young writers in this ACOT classroom clearly changed their writing strategies over the year as a result of writing every day on their computers. Previously, when students wrote by hand, they were economical with words, recording their thoughts in the fewest words possible and permitting them to remain static. They created and finished their compositions in one draft. Later, when writers were keyboarding comfortably and faster than they could handwrite, they began expressing their ideas in far greater detail. They recorded initial thoughts and then rewrote them for better clarity or because their ideas had evolved. They also viewed words on the computer screen as more fluid and changeable than words on paper.

Further study in the area of how students' writing strategies change with daily use of computers would

identify more specifically technology's impact on student writing. Such a study would address questions such as: What writing strategies do students employ when they write with computers daily and how have their writing strategies changed? How many and what kinds of text alterations do students make when the text is visible on the computer screen compared to when it is printed on paper? A study of how students revise text on computers could also examine the differences between revisions made by students alone, and revisions made while working collaboratively.

It is evident that students' writing and their approaches to writing change when they write with computers regularly. However, a closer analysis of what those changes are is critical in order for educators to determine how best to implement technology in the teaching of writing.

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